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EVALUATION OF MOTOR PLANNING TECHNIQUES FOR THE TREATMENT OF STUTTERING.

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THERAPY PROCEDURES BASED ON MOTOR PLANNING TECHNIQUES WERE DEVELOPED FOR THE TREATMENT OF YOUNG ADULT STUTTERERS. THE SUBJECTS FOR THIS STUDY WERE 24 MALE UNIVERSITY STUDENTS RECEIVING THERAPY FOR STUTTERING. USING RATINGS OF THE SEVERITY OF THEIR OVERT STUTTERING, THE INVESTIGATOR DIVIDED THE SUBJECTS INTO AN EXPERIMENTAL GROUP AND A CONTROL GROUP. SUBJECTS IN THE EXPERIMENTAL GROUP WERE TRAINED IN THE USE OF MOTOR PLANNING TECHNIQUES IN ADDITION TO RECEIVING CONVENTIONAL THERAPY. SUBJECTS IN THE CONTROL GROUP RECEIVED ONLY CONVENTIONAL THERAPY. TAPE RECORDINGS WERE MADE DURING PERIODS OF SPONTANEOUS SPEECH BY THE SUBJECTS AND WHILE THEY READ ALOUD AT THE BEGINNING, MIDDLE, AND END OF THE STUDY. SUBJECTS ALSO COMPLETED THE "STUTTERER'S SELF-RATINGS OF REACTIONS TO SPEECH SITUATIONS" AT EACH OF THESE THREE POINTS IN THE STUDY. AT THE END OF THE STUDY, THREE DOCTORAL CANDIDATES USED A MODIFIED VERSION OF THE "IOWA SCALE FOR RATING SEVERITY OF STUTTERING" TO RATE THE SEVERITY OF RESPONSES ON THE TAPE RECORDINGS. THE RATINGS WERE COMPARED WITH THE SCORES OBTAINED ON THE SELF-RATING INVENTORY. CONCLUSIONS OF THE STUDY INDICATED THAT--(1) A GROUP OF SUBJECTS TRAINED TO USE MOTOR PLANNING TECHNIQUES IN ADDITION TO RECEIVING CONVENTIONAL THERAPY DID SHOW A GREATER REDUCTION IN THE SEVERITY OF THEIR STUTTERING THAN A GROUP OF STUTTERERS WHO RECEIVED ONLY CONVENTIONAL THERAPY, (2) THE MOTOR PLANNING TECHNIQUES DEVELOPED FOR USE IN THIS STUDY CAN BE USED TO HELP YOUNG ADULT STUTTERERS FORM, CONSTRUCT, AND EVOLVE MOTOR PLANS DESPITE THE PRESENCE OF ANTICIPATION-ANXIETY. THEREFORE, THESE TECHNIQUES WERE FELT TO CONSTITUTE A SET OF THERAPY PROCEDURES USEFUL TO PROFESSIONAL WORKERS. THE INVESTIGATOR CAUTIONED THAT THESE CONCLUSIONS SHOULD BE REGARDED AS TENTATIVE IN VIEW OF THE SMALL SAMPLE OF SUBJECTS AND THE LACK OF SIGNIFICANT BETWEEN-GROUP DIFFERENCES. (WB)

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Speech and Hearing Clinic
Department of Special Education
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PREFACE

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James V. Frick

University Park, Pa.
September, 1965

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PROBLEM

The speech disorder of stuttering affects approximately 350,000 persons under the age of 21 in the United States. A fundamental assumption of the present study was that a major factor which acts to elicit stuttering is a deficit in the motor plan of the stutterer. By deficit in motor plan is meant that the stutterer, when experiencing fear and/or anticipation of stuttering, does not or is not able to plan the sequence of motor acts necessary to utter the word or phrase or longer unit envisioned by the stutterer. As a result, the stutterer is not able to continue speaking beyond the point of breakdown in the motor plan and this is one reason, although probably not the fundamental one, why a given moment of stuttering occurs.

OBJECTIVES

The purpose of the present study was to test the hypothesis that a group of stutterers who are trained to use motor planning techniques in addition to receiving conventional therapy will show a greater reduction in the severity of their stuttering than a matched group of stutterers who receive conventional therapy only.

RELATED RESEARCH

Although there are hints in the writing and clinical practice of some workers in the field of stuttering as to the motor plan and its importance in speech and in stuttering, there are no explicit, formalized procedures based upon the motor plan in present-day therapy practices with persons who stutter.

The notion of the motor plan is not a new one. It is found in the writings of a number of outstanding authorities who have addressed themselves to the general topic of motor behavior. For example, Faillard said:

> We find here again the problem of the nature of the plan of movement that is classically considered as a necessary prerequisite to all volitional activity . . . . It supposes the existence of a so-called motor image or representation of the movement to be accomplished. (1960, p. 1693)

Schilder (1950) also addressed himself to this question of the motor plan. Nielsen (1948) discussed motor planning within the general framework of various types of apraxia. Lashley (1951), while not using the phrase motor plan, seemed to have the general notion in mind when he discussed the importance of order in serial motor behavior.

The motor plan, or some variation of it, was of interest to a number of earlier writers on stuttering. Robbins said:

> You cannot pronounce a difficult foreign word correctly the first time, because you can have no kinaesthetic image of the movements of the lips and tongue required to utter that word until you yourself have once pronounced it correctly. Before you can speak any word,

> therefore, you must have a mental image both of the way it sounds and of the muscular movements of the lips, tongue, and jaw required to pronounce it. If either the auditory or the kinaesthetic image of a word is indistinct, you are likely to stammer on that word. (1926, p. 29)

Fletcher commented:

> The notion of vowel stuttering, which seems to an auditor to be an inability to leave off a vowel sound once it has begun, arises from what the author takes to be a misinterpretation of what is really happening. This seeming inability to leave off a sound after it has begun is in reality an inability to effect articulate speech by connecting the sound being given with the succeeding one, so as to form significant, meaningful speech. (1928, p. 179)

Bleumel was somewhat more specific when he said:

> The subject of spasm deserves further study. It is one of the aspects of stammering that has received much attention in descriptive writings on speech defects. Personally, I am inclined to the view that spasm is nothing more than the abortive struggle that results from the stammerer's effort to speak with unaided motor images. (1930, p. 4)

More recently Van Riper, in a section devoted to "teaching the speech attempt as a voluntary movement sequence" says:

> From this description we see the three criteria of a dynamic speech attempt: (1) the mouth must be kept in motion; (2) the contacts must be light, lest the movement be interrupted, and (3) the succeeding sound must be prepared for in mouth and mind so that the movement may have direction. (1954, p. 439)

What types of evidence are available that the stutterer has difficulty in motor planning? One form of evidence is the very frequent tendency for the schwa vowel to appear after a consonant on which a repetitive block is occurring. For example, when many stutterers experience

a moment of stuttering on the initial consonant of the word "Saturday", they produce sə-sə-sə rather than sæ-sæ-sæ. The percentage of stutterers who do the latter is very small. Why do most stutterers in this situation say sə-sə-sə? The reason seems to be that they do not have in mind a motor plan which will even carry them through the first syllable of the word "Saturday". Instead, they motor plan only for the consonant at the beginning of the word, - in this case the [s] sound. If they have a repetitive type block, they will say sə-sə-sə because the schwa vowel, as the neutral vowel, is the one most likely to be emitted. Of course, if they have a prolongation on the initial sound of this word, the listener will hear nothing but a prolonged [s]. Indeed, this incomplete motor plan and the resulting appearance of the schwa vowel rather than the vowel which should appear after the consonant on which difficulty is being experienced seem to be reasons why the repetitive type of stuttering occurs, that is, the stutterer repeats the sə-sə-sə in a random, unguided attempt to strike upon the right combination of the [s] and [æ] phonemes. Typically, once this right combination is found, the entire word is then emitted with a very low probability of any stuttering on the remainder of the word.

Another type of evidence is that quite often when the stutterer experiences difficulty on a word other than the first word in a phrase, he will go back and repeat all of

the phrase preceding the word he is stuttering upon. It is suggested here that this happens because in typical non-stuttered speech the speaker, stutterer or non-stutterer, motor plans in something more than one-word units - more likely a phrase unit or perhaps two or more phrases.

Another type of evidence is the fairly common report from people who stutter that "I was just stuck. I couldn't get anything out." Such a comment seems to be of special interest in those cases where there is little if any tension or tremor occurring in the articulators of the stutterer. Sometimes, indeed, the stutterer will even use such phrases as, "I just seemed to black out there. I was not able to go on." Such comments should not be regarded merely as figurative modes of speech by the stutterer; instead, it should be considered seriously that the stutterer's report is valid in that he could not "go on." It is suggested here that he could not go on because he had suffered a breakdown in motor planning and so was unable to utter anything beyond the point at which the "block" occurred.

It is suggested by the present writer that one reason why the stutterer's motor plan breaks down is that he puts his articulators into an unnatural position as part of "getting ready" for the point in the sequence which is perceived to be difficult. As a result of being in this unnatural position, he literally does not know how to get out of it - because he has departed so far from the

correct and unconscious sequence of overlapping movements that he cannot get back into the right sequence. It seems not at all unlikely that the reason why many stutterers go back and repeat several words which preceded the word on which the block is taking place is that they are attempting to start over again in the right sequence, hoping that they will be able to complete that right sequence in its entirety without interruption. This type of behavior on the part of the stutterer seems quite analagous to what the musician will do when he has played a note incorrectly. The probability is that the musician will return to the beginning of the passage and play that entire passage again. This he will do in contrast to any attempt to stop immediately after playing the given note incorrectly, play that note again correctly, and then continue from that point to finish the rest of the passage.

It should be clearly understood, of course, that the occurrence of anxiety and/or anticipation is probably the initial link in the chain that leads ultimately to the actual occurrence of overt stuttering and that this anxiety and/or anticipation must be regarded as the principal target for therapeutic efforts. At the same time, it is recognized by all therapists that a quick elimination of anxiety on the part of a stutterer is very difficult to achieve,and it may be impossible to enable the stutterer to be free from all fear or anxiety about the speaking act when the problem has persisted into late

adolescence or adulthood. If the stutterer can be helped to form, construct, evolve motor plans <u>despite</u> the presence of fear, anxiety, anticipation, this would seem to offer considerable hope as a therapeutic technique.

PROCEDURE

Overview

The subjects for this study were 24 male university students receiving therapy for stuttering at the Speech and Hearing Clinic of The Pennsylvania State University. Using ratings of the severity of their overt stuttering, the subjects were divided into an Experimental group and a Control group. Subjects in the Control group received conventional therapy; subjects in the Experimental group were trained in the use of motor planning techniques in addition to receiving conventional therapy. Tape recordings were made of the spontaneous speech of the subjects and while they read aloud at the beginning (January), middle (March) and end (May) of the study; in addition, the subjects completed the Stutterer's Self-Ratings of Reactions to Speech Situations at each of these three times. At the end of the study, three doctoral candidates at the University of Pittsburgh used a modified version of the Iowa Scale for Rating Severity of Stuttering to rate the severity of stuttering on the tape recordings. These severity ratings and the scores on the Stutterer's Self-Ratings inventory were compared to determine whether the Experimental group showed a greater reduction in severity of stuttering than the Control group.

Subjects

Subjects for the study were 24 male university students who were receiving speech therapy for stuttering at the

Speech and Hearing Clinic of The Pennsylvania State University. Eighteen students were subjects in the study during the Winter, 1965 academic term (January-March). One of these subjects withdrew from therapy at the end of the Winter term, and six new subjects began to receive therapy in the Spring, 1965 term (March-May) making a total of 23 subjects in the Spring term.

The 12 subjects in the Experimental group ranged in age from 18 years, 6 months to 24 years, 4 months with a mean age of 20 years, 3 months. The 12 subjects in the Control group ranged in age from 17 years, 1 month to 23 years, 8 months, with a mean age of 20 years, 2 months. At the time of entry into the study (January or March), the mean number of terms of previous therapy at the Penn State Clinic was 1.8 for the Experimental group and 1.0 for the Control group.

Division of Subjects into Groups and Types of Data Collected

At the beginning of the Winter term, it was necessary to divide the pool of 18 subjects into an Experimental group and a Control group. This was done by dividing the subjects into two matched groups (matched on the basis of ratings of severity of overt stuttering) and, then, designating one group as Experimental and the other as Control by means of the flip of a coin. First, a three minute segment of spontaneous speech was tape recorded as the subject described a series of six line drawings. The

instructions read to each subject are shown in Appendix A, and the series of line drawings is shown in Appendix B. Specifically, the task of the subject was to describe each drawing in such a way that another person could reproduce the drawing using only the recorded description. Each subject was timed, using a stopwatch, and was stopped at the end of three minutes. Next, at the same session, a two-minute segment of speech was recorded while the subject read aloud a 230-word passage titled Lightning (a copy of which is shown in Appendix C). Here, too, each subject was timed using a stopwatch and was stopped at the end of two minutes if he had not already finished reading the entire passage. So, a tape recording was made for each of the 18 subjects consisting of a three-minute segment of spontaneous speech and a two-minute segment of reading aloud.

These tapes were then judged for severity of stuttering by three speech therapists - each of whom had one or more years of paid professional experience in addition to having completed the academic requirements for the Master's degree at The Pennsylvania State University. The judges used a modified version of the Iowa Scale for Rating Severity of Stuttering. As reported in Johnson et al (1963), the Iowa Severity Scale represents a continuum from 0 (no stuttering) through 1 (very mild stuttering) to 7 (very severe stuttering). Each scale value is defined on the basis of five dimensions of stuttering, namely, frequency, tension, duration of moments of stuttering,

complexity of pattern of stuttering, and conspicuousness of associated movements. The scale value definitions seem based on the assumption that the five dimensions covary uniformly, for example, that an increase in frequency of stuttering is accompanied by an increase in the tension of the stuttering, that an increase in duration is accompanied by an increase in associated movements, etc. However, use of this scale at Penn State has shown that the five dimensions of the scale do not covary uniformly for most stutterers. More reliable judgments are possible by making a separate rating for each dimension and such a practice was followed in this study. Because the ratings were made from tape recordings, the dimension of conspicuousness of associated movements could not be used; the dimensions of frequency, duration, tension, and complexity were each rated separately on a seven-point scale (the scale value of 0 was not used). A copy of the rating instructions and a copy of the rating sheet are shown in Appendix D and Appendix E, respectively. As may be noted on the latter, one set of ratings was made for the sample of spontaneous speech and another set of ratings for the sample of reading aloud. Thus, each judge made eight ratings per subject--four ratings on spontaneous speech and four on oral reading.

Having obtained the ratings from the judges, they were then combined as follows. The median of the three ratings (one by each judge) for "Frequency" in the spontaneous speech segment for, say, Subject #1 was determined;

then, the median of the three ratings for each of the other seven judgments was determined. At this point, a median rating was available for Subject #1 on each of the four dimensions for each of the two speaking conditions. Next, the median of the four ratings for Spontaneous was determined for Subject #1 and the median of the four ratings for Reading was determined for Subject #1. These two median ratings of severity of overt stuttering for each of the 18 subjects were used to divide the 18 subjects into two matched groups. Then, on the basis of the flip of a coin, one group was designated as Experimental and the other as Control. The median ratings and resultant matchings are shown in Table 1. As noted there, the subject numbers are preceded by "E" or "C" indicating membership in the Experimental or Control group. (The ratings for the six subjects who were added in the Spring term are also shown in Table 1 - E10, E11, E12, and C10, C11, and C12. Subject C3 was the subject who withdrew from therapy after the end of the Winter term.)

At the end of the Winter term, a five-minute tape recording was made of the speech of each of the 18 subjects. The procedure was identical to that followed in the making of the recordings at the beginning of the Winter term. Three minutes of spontaneous speech were recorded as the subject described a new series of six line drawings (shown in Appendix F); two minutes of speech were recorded as the subject read aloud a passage titled <u>Glass</u> (Appendix G).

Table 1. Severity ratings in spontaneous and reading situations for experimental and control subjects.

	Experimental			Control	
Subj.	Spontaneous	Reading	Subj.	Spontaneous	Reading
E1	7	6.5	C1	7	7
E2	6.5	5.5	C2	6.5	6.5
E3	5	5	C3	5	4.5
E4	5.5	3	C4	5.5	2.5
E5	4.5	4	C5	4	3
E6	4	2	C6	4	1
E7	4	2	C7	2	2
E8	3.5	2	C8	2	1
E9	1	1	C9	1	1
Mean	4.55	3.44		4.11	3.17
E10	1.5	1	C10	1	1
E11	3.5	3.5	C11	5.5	3
E12	5	2.5	C12	4.5	2.5
Mean	3.33	2.33		3.66	2.16

At the beginning of the Spring term, eight new students applied for therapy for their stuttering problem. One of these students was not included in the study because his class schedule did not permit him to attend some therapy sessions, and a second student was not used for the study because his severity ratings were such that he could not be matched with any of the other new subjects. So, six new subjects were available to be included in the study.

During the first week of the Spring term, a five-minute tape recording was made of the speech of each of the six new subjects. The procedure was identical to that followed in the making of the recordings at the end of the Winter term. Three minutes of spontaneous speech were recorded as the subject described the second series of six line drawings (Appendix F); two minutes of speech were recorded as the subject read aloud the passage titled Glass (Appendix G). The tape recordings for the six new subjects were listened to and judged for severity by the same three speech therapists who made the severity ratings at the beginning of the Winter term, and the same judging procedure was followed. The ratings by the therapists were converted into a median rating for each subject of his spontaneous speech and of his reading aloud. These ratings were then used to divide the subjects into two matched groups; then, one group was designated as Experimental and the other as Control by means of the flip of a coin.

At the end of the Spring term in May, a five-minute

tape recording was made of the speech of each of the subjects. A third series of line drawings was used to obtain three minutes of spontaneous speech (Appendix H) and a passage titled Rainbow (Appendix I) was used for the two minutes of reading aloud.[1] With the making of this set of tapes in May, three tapes were available for each of the 17 subjects who entered the study in January and remained through May, two tapes were available for the subject (C3) who entered the study in January and withdrew in March, and two tapes were available for each of the six subjects who entered the study in March, making a grand total of 65 tapes. These 65 tapes were spliced together in a random order to comprise a master tape which was then used to obtain the severity ratings which make up part of the basic data of the study. Three doctoral candidates in speech pathology at The University of Pittsburgh used the modified version of the Iowa Scale to make severity ratings of each tape following the identical procedure used by the three therapists at Penn State when severity ratings were made to be used in matching the subjects, and the ratings were combined in the same manner. For example, the median of the three ratings (one from each judge) for "Frequency" in the spontaneous speech segment for Tape #20 was determined; then, the median of the three ratings for each of the other seven judgments was determined. Next,

---

[1]In addition to number of words, the three reading passages, Lightning, Glass, and Rainbow, were equated for readability and distribution of Spencer Brown's word-weights by Peins (1958) and Shrum (1960).

the median of the four ratings for Spontaneous on Tape #20 was determined as was the median of the four ratings for Reading. This process resulted in ten scores for each tape - five for Spontaneous and five for Reading. The ten scores for each tape for each subject are shown in Appendix J (basic data appendix).

In addition to the severity ratings based on the taped samples of speech for each subject, another kind of data available for each subject was his responses on the Stutterer's Self-Ratings of Reactions to Speech Situations (1963). The stutterer using this inventory rates himself on a 5-point scale with respect to the frequency with which he meets 40 speaking situations, the degree to which he avoids them, enjoys speaking in them, and stutters in them. In the present study, the median score for each of the four aspects was obtained; then, these four scores were combined by taking their median. The inventory was administered at the beginning of the Winter term, the end of the Winter term, and the end of the Spring term. So, the 17 subjects who entered the study in January and remained through May completed the inventory three times, Subject C3 completed it two times, and the six subjects who began in March completed it two times. The five scores obtained at each administration are shown for each subject in Appendix J (basic data appendix).

In order to determine the consistency of judgments of severity made by the three judges at the University

of Pittsburgh, upon the completion of their ratings of the 65 tapes made for this study, they listened to and rated again 14 of these same tapes.

Therapy Program Organization

During the Winter term, therapy was provided for the 18 subjects by three graduate assistants in the Speech and Hearing Clinic of The Pennsylvania State University. Each of these three clinicians had received the Bachelor's degree in speech pathology in June of 1964 and began their graduate work toward a Master's degree at Penn State in September of 1964. Two of the clinicians were female and one was male.

During the Winter term, each clinician provided therapy for six subjects, three from the Experimental group and three from the Control group. The subjects were assigned to the therapists on the basis of relative degree of severity, that is, each clinician worked with one severe subject, one moderately severe subject, and one mild subject within each group. Each subject received one hour of individual therapy per week and one hour of group therapy each week. For the group therapy, the members of each group being seen by each therapist met once each week. For example, the three Experimental group subjects of Clinician A met together with Clinician A once a week, the three Control group subjects of Clinician A met together with Clinician A once a week, etc.

One of the female therapists withdrew from the

University at the end of the Winter term. So, during the Spring term, therapy was provided for the 23 subjects seen during that term by the two remaining clinicians. In the Spring term, each subject once again received one hour of individual therapy each week, and one hour of group therapy each week. Each clinician provided therapy for six Experimental group subjects and six (or five[2]) Control group subjects. Because of the increased number of subjects per clinician, each clinician met for group therapy four times each week. For example, Clinician A met with three Experimental group subjects once per week and, at another time, met with the other three Experimental group subjects for an hour of group therapy; in similar fashion, Clinician A met with three Control group subjects once a week and, at another meeting, met with the other three Control group subjects for an hour of group therapy.

Therapy Techniques Employed

It will be recalled that the general research strategy of this study was that subjects in the Control group would receive conventional therapy, while subjects in the Experimental group would receive conventional therapy plus training in motor planning techniques. The therapy received by each group during the Winter term is described below.

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[2]One clinician had only five Control group subjects because Subject #C3 withdrew from therapy at the end of the Winter term.

Experimental Group - Winter Term

I. Structuring

In the case of a new subject who had never received therapy at the Penn State Clinic, the first meeting was devoted to beginning to become acquainted with the subject and to the establishment of rapport. If the subject had been receiving therapy at the Penn State Clinic during the preceding academic term and so was known to the clinician, a re-establishment of rapport was accomplished, and perhaps at the first session a beginning was made in explaining to the subject the general nature of motor plan therapy.

During the first week of the Winter term, the experimenter met with the Experimental group subjects of each clinician and explained to them the rationale for the motor plan therapy approach. The experimenter began the explanation by stating that the basic assumption of the approach was that a defective motor plan comprised part of the reason for the occurrence of the stuttering experienced by the subjects. The nature of motor planning was explained mainly through the use of illustrations drawn from the area of athletic activity. This technique seemed to work well, probably because all the subjects were young adult males who had or still were participating in sports activity. One especially helpful illustration was based upon the diving of a skilled diver from a ten or twelve-foot high diving platform. Subjects were reminded that, in a diving competition, the diver will be seen to stand

motionless for what seems like quite a long time at the back of the platform before he begins to move forward along the platform or diving board and execute his dive. The subjects were told that the diver, as he stands motionless in such a manner, is mentally rehearsing or running through the precise sequence of motor acts which he will execute in the dive, beginning with the first step he takes from the point where he is standing, preparing for the execution of the dive. Another example found helpful with this group was that of what takes place while one is addressing a golf ball, preparing to swing. Again, it was pointed out to the subjects (and many of them had played golf so could agree from their own experience with the description made by the experimenter) that the golfer, the beginning golfer in particular, is giving himself a variety of interrelated instructions as he stands over the ball in preparation for the swing. One other example of skilled, sequential motor activity that seemed to be meaningful for the subjects was that of the ballet dancer. Here, the point was very easily made that probably one reason why the unskilled ballet dancer looks clumsy and awkward was because of relative inability to move smoothly from one position or act to another, whereas the highly skilled dancer goes through a series of unbroken, fluid, smoothly flowing sequences of movements. Through the use of examples of this type, the subjects in all cases seemed to immediately accept the validity of the motor plan concept in skilled motor activity.

Having established this point, the experimenter next pointed out that in most skilled motor activity the motor plan is an unconscious, or relatively unconscious, determiner of the motor act. Along this line, the explanation turned to speech and the motor plan in speech when it was pointed out that under normal conditions, the fluent speaker merely "talks" with no conscious motor planning being performed at all. For those persons who stutter, however, the experimenter restated his basic premise, namely, that in moment of anxiety and/or anticipation of stuttering, the stutterer experiences an interruption of his motor planning ability so that the occurrence of a given stuttering block is some function of the interruption of motor planning. At this point, examples were given from the area of stuttering. As part of the giving of the examples, the experimenter began to talk in terms of a deficit in auditory and/or kinesthetic imagery as perhaps the basic nature of the motor planning deficit. One example used was that of a stutterer who anticipated stuttering on his first name, Bill. The experimenter reminded the subjects that quite often in such a case the stutterer, as he is preparing to say such a word as Bill, will not be able to "hear beyond" or "feel beyond" the first sound in his name, namely the /b/ sound. Since the typical stutterer does have more than usual difficulty in saying his own name, this example was a meaningful one for the subjects, including the experimenter's suggestion of

some sort of a breakdown in the imagery of the stutterer. Another example used was what happens when the stutterer unexpectedly finds himself in the type of block where he is experiencing a tight, unmoving contact of the articulators, such as having the tongue pushing tightly against the alveolus when attempting to say such a word as Tuesday. The subjects were reminded that quite often in such a case, the stutterer seems to go through a random "blind" struggle to free his tongue from the position into which he has put it. The experimenter quoted a former stuttering patient of his, who in referring to his stuttering problem, described it by saying "I'm trying to force out something which isn't there".

At about this point, the experimenter summarized what he had said, and concluded on the point that what we wanted to do together was to evolve and practice certain techniques which presumably would aid them to consciously use better motor planning when anticipating a moment of stuttering or when actually in the process of stuttering. The experimenter was pleased, and somewhat surprised, to find that the kind of explanation described above seemed to be accepted quite readily by the subjects in all three of the experimental groups, despite the fact that the concept and the term motor plan was an unfamiliar one to the subjects.

II. Developing Awareness of Breakdowns in Motor Planning

The basic approach here was for the clinician in the

individual therapy session to ask questions of the subject which would involve a brief answer. During the moment after hearing the question, but before attempting to say his answer aloud, the subject was to note whether he expected to stutter in his answer and, if so, to describe any felt deficit in imagery. For example, the clinician might ask "What day is it today?" Assuming the day was Tuesday, and if the subject expected to stutter on the word when he went to say it, his task was to describe whether he had a kinesthetic cue that he might stutter or whether he had an auditory cue that he might stutter of such a nature that he could only hear himself saying part of the word, or even whether he experienced a deficit in visual imagery of such a nature that he "see" only the first letter of the word, the T. In addition to asking questions of the subject, the other technique used to elicit this kind of self-examination by the subject was as the latter read silently. Specifically, as he read silently, if and when he anticipated stuttering on a word, he was to do the same kind of self-examination described above when answering questions put by the clinician.

III. Becoming Aware of Fluency

The fundamental aim here was to have the subject attend to his fluent speech. As Van Riper has pointed out, the stutterer usually only attends to his stuttered speech and ignores the fluent speaking which he does. The individual clinician attempted to have each subject hear how

his fluent speech sounded, feel the ongoing tactual and kinesthetic sensations during fluent speech, and see how he looked during fluent speech by watching himself in a mirror while speaking fluently. In addition to the use of the subjects' spontaneous speech for the above purposes, tape recordings of each subject's fluent speech were also used. The recordings of fluent speech were obtained by having the subject read the same short passage over and over again until the adaptation effect produced a fluent or almost completely fluent reading. Another technique to obtain a fluent recording was for the clinician to read aloud together with the subject, but with the clinician far enough away from the microphone to the tape recorder so that the latter's voice was not audible on the recording.

The recording of fluent speech was used in a number of ways. In one, the subject simply sat and listened very carefully to the recording of his fluent speech as it was played for him a number of consecutive times. Another and more frequent use of the recording was to have the subject listen carefully to a phrase of his fluent speech and then to repeat that phrase immediately, trying to recapture the same degree of fluency when he said the material spontaneously; the clinician turned off the tape recorder at the end of the phrase in question so that there was no other material being produced while the subject repeated the phrase. After the subject had repeated the phrase

trying to achieve the same amount of fluency, the clinician would turn the machine back on so that another phrase was played and the same procedure would be repeated. A third way in which the fluent recording was used was in cases in which material had been read aloud by the subject and recorded. With this kind of recorded material, as it was played back, the subject read aloud the identical material, attempting to "keep in time" with his own recorded voice as exactly as possible. This latter procedure came to be called "tracking" during the course of the study.

IV. Improving One's Motor Planning Ability

One technique used was taken from Bluemel (1957, p. 91) who refers to it as establishing the habit of fluent thinking.

> The pupil begins this phase of the work by answering questions, not in spoken words, but in fluent, silent speech. The therapist puts the question, "What is your name?" "How old are you?" "When were you born?" "What is your address?" "Who are the members of your family?" "How many windows are there in this room?" When the pupil thinks his answer in clear-cut, broadcastable words, he signals the acceptable quality of the response by raising the right hand. If he 'fluffs' the answer, he identifies a miss by raising the left hand. Fluffing consists in 'thinking a blank', stammering in verbal thinking, or muddling the mental words. The pupil soon learns to identify the pattern. After fluffing an answer, the stammerer repeats his attempt, and on thinking a clear-cut answer, he identifies it with the signal. (1957, p. 91)

This procedure was used in this study exactly as described by Bluemel. The rationale for the above type of procedure, according to Bluemel, is that the stutterer

hears and feels his stammering before the speech attempt is begun, and as a result stuttering speech does appear in overt form because of the fact that stammering originates in the inner speech. In the context of the present study, the procedure was an attempt to train the stutterer to develop a voluntary, conscious motor plan of non-sutttering speech.

A second technique under this heading was to have the subject stop immediately after a stuttered word and repeat that word aloud as many times as necessary to be able to say it with no stuttering at all. As the subject said the word aloud as many additional times as necessary, he was directed to focus his attention on what was assumed to be an emerging motor plan. The assumption here was that as each successive utterance approximated more and more closely a completely fluent utterance of the word, the subject would be able to bring more clearly into consciousness the sequence of motor events which go to make up the motor plan for that particular word. (In the Spring term, to be described below, a similar procedure was used in having the subject repeat aloud the entire phrase in which a stuttering word occurred as many times as necessary so as to be able to say that word fluently within the entire phrase.)

V. Cancellation of Entire Phrases

The technique of cancellation was devised by Van Riper and has been described by him in a number of his

publications. The standard way of employing cancellation is as follows: Immediately after a stuttered word, the stutterer stops and pauses. During the pause, he first of all analyzes exactly how he stuttered on the word, and then secondly, still within the pause, he plans in detail exactly how he will say that same word again. Then he does repeat the word aloud, presumably following the detailed plan evolved during the pause. In line with the belief of the experimenter in the present study that motor planning for speech is probably done in larger units than single words - most likely in one or more phrase units - the subjects in the Experimental group were trained in a type of cancellation in which the entire phrase was repeated in which the stuttered word had appeared. For example, if the stutterer was planning to say "I am going to the movies" and he stuttered on the word 'to' in this utterance, he did not stop immediately after the word 'to' but was instructed to finish the utterance, "I am going to the movies" and then to stop after the word 'movies'. Then, during the pause, he would analyze how he had stuttered on the word 'to' and plan to say the entire phrase over again including his specific plan involving the word 'to'. Finally, he then did repeat the entire phrase presumably in exactly the way he planned during the pause.

A third technique to help in the improvement of motor planning ability involved the use of binaural headphones. The subjects listened to their own fluent recording through

the headphones and attempted to "track" a syllable or two behind the recording. This was aimed at creating a more conscious awareness of the sound and feel of his own fluent speech as he attempted to model it. In the same way, while wearing the binaural headphones, the subject listened to and "tracked" behind the clinician as the clinician read a passage. In this way, the subject was encouraged to become aware of his own fluency as he attempted to imitate the fluent speech of a normal speaker.

VI. Attempting to Maintain Fluency During Spontaneous Speech, Even Though Some Degree of Anticipation of Stuttering is Present.

The general aim of this phase of the training was to enable the Experimental group subjects to use techniques described above under III and IV in their spontaneous speech both inside and outside the Clinic. In order to accomplish this aim, the situation was so arranged in the Clinic that a maximum of fluency was produced by the subject. Once this high level of fluency, at least relatively, was being produced by the subject, he was instructed to attend closely to any cue which entered his consciousness as to the possible approach of even the slightest degree of stuttering. He was instructed to make every effort to evolve the kind of motor plan that would enable him to maintain the on-going fluency of his speech despite the incipient breakdown of his motor planning. For example, if he began to have a "fuzzing out" of his kinesthetic or auditory imagery for a given word, perhaps a word in the

next sentence to be uttered, he was to apply the ability acquired during the simpler tasks described above under III or IV so as to evolve at least a relatively clearer kinesthetic or auditory imagery of the word in question than would otherwise have been the case. After a degree of success was possible using this technique in the Clinic, the subject began to use it in extra-Clinic situations as well.

VII. Conventional Therapy

The subjects in the Experimental group were given training in the above techniques in addition to training in the conventional therapy methods for the adult stutterer. The conventional therapy methods used in this study were a combination of work on the overt stuttering of the subjects and the relevant attitudes and feelings of the subjects. They are described in detail below under the section "Control Group - Winter Term".

VIII. Group Therapy

It will be recalled that each subject met with two other of the subjects from his group once a week for one hour of group therapy. Over and above the opportunity that such group therapy affords for discussion by persons who stutter of their feelings, attitudes, progress, etc. the meetings for the Experimental group subjects were used to discuss together their common work on the motor planning techniques. One important feature of these group meetings

for the Experimental group subjects was the opportunity provided the subjects to practice their newly acquired skills in the presence of persons other than their own clinician, but still without being subject to the full pressures which might be encountered in extra-clinic situations.

Control Group - Winter Term

The conventional therapy approaches and techniques used for the Control group (and the Experimental group) are described below.

I. Establish Rapport

The usual attention was given to becoming acquainted with any new subjects or becoming reacquainted with subjects who had been patients in the Clinic during the previous term.

II. Describing and Discussing the Nature of the Problem

Here, the clinician discussed stuttering in the adult as an interrelated combination of a set of learned mal-attitudes and secondary symptoms. The role of anxiety-anticipation was stressed in the precipitation of given moments of stuttering, together with the role of the learned motor behavior that comprises the visible and audible aspects of stuttering. The clinician demonstrated his or her expertise in stuttering by showing intimate knowledge of the feelings of the typical stutterer as a moment of stuttering approaches, feelings usually experi-

enced during the given moment of stuttering, and the feelings usually experienced after the moment of stuttering. The strength and tenacity of the habit aspects of stuttering were recognized by the clinician but, at the same time, the clinician attempted to have a strong note of optimism pervade all these remarks along the lines that speech pathologists have come to know a great deal about stuttering and how to help those persons who do stutter. Finally, the general plan of approach with some details was described for the new subject in particular.

III. Identifying Each Subject's Own Pattern of Stuttering Symptoms and Malattitudes and Fears

The kind of discussion described above under II led quite nicely into the subject's beginning to describe for himself and his clinician his feelings and some of his overt symptoms. Typically, however, the new subject was relatively unknowledgeable about the details of his own overt symptoms and much of this was left for the clinician to point out for the subject. A frequent approach was for the clinician and the subject to work together in the preparing of an inventory of the subject's symptomatology. In this approach, not only were the overt manifestations identified, but the subject was introduced to the new "vocabulary" of symptomatology such as prolongation, repetition, tight contacts, head jerks, preformations, fixed postures, etc. As part of this general phase of the work, the role of many secondary symptoms in acting as a trigger

or release device was pointed out to the subject. In turn, it was pointed out for the subject how in many ways the "basic stuttering block" is a relatively simple, uncomplicated matter which is often made much more complicated by the conspicuous, sometimes bizarre, secondary symptoms used by the stutterer to "release" himself from something like a fixed posture, tight contact, series of repetitions, etc. Wherever possible, remembering that the new subject had only been in therapy for two or three weeks at the most, the clinician would point out the role of non-stuttering anxiety in contributing to the elicitation of stuttering. For example, in a university setting, the well-known increase in stuttering for many patients when an important examination is scheduled in one of the patient's courses was used to illustrate the point.

IV. Eliminating Secondary Symptoms

Here, an attempt was made to assist the subject to eliminate one or two of his more obvious secondary symptoms. Various devices such as a tape recorder and/or a mirror were used to enable the subject to become more aware of the given symptom. When this first step was accomplished fairly well, the patient was given training in working to consciously prevent the appearance of the symptom. Working to achieve better eye contact was often one of the secondaries worked on in this phase of the program, since it responds well to therapy of this kind.

V. Improving Attitudes

Through the media of explanations by the clinician, discussion between subjects and clinician, discussion between subject and other subjects in group meetings, carefully prepared situational assignments to be done by the subject outside the Clinic, etc., the relevant attitudes of the subjects were improved.

VI. Use of Controls

After a fair amount of progress had been made on IV and V, a more direct kind of effort was introduced along the lines of "controls" as devised and perfected by Van Riper.

One such method of control is the Stop-Go. In this method, the stutterer interrupts the act of speaking while in the act of stuttering, for example, if a person is having a repetitive block on the word "revolver", he stops as soon as he can, say after the second repetition of the syllable "re-". Having stopped, the stutterer then brings the articulators to a rest or neutral position for pehaps one or two seconds, then resumes the act of speaking by saying the rest of the word. In the example being used here, after the pause the stutterer would say "-volver". Another control that was used was that of cancellation in which the stutterer stops immediately after a stuttered word, pauses briefly while he analyzes the stuttering he did and plans how he will repeat the word, and then does go ahead to repeat the word in the planned

manner. There are a variety of types of cancellation. The subjects in this study were usually given three or four types to work upon. Another control which was used was the pull-out. In this control, the stutterer does not interrupt the act of speaking while stuttering on a word, but rather fights for control of his speech by changing whatever he is doing into a smooth prolongation of the phoneme on which the block is occurring, and then, having gained complete control, says the rest of the word in a smooth, non-stuttering manner. The techniques of cancellation and pull-out are described in Van Riper (1963).

VII. General

The above general aims were worked on in both individual and group therapy sessions. About every other week, the clinician and the subject left the Clinic together for the subject to enter a variety of speaking situations so that the clinician would have the opportunity to observe the subject in these more life-like speaking situations.

Experimental Group - Spring Term

The three subjects who became members of the Experimental group for the first time at the beginning of the Spring term received the program of therapy as described above for the Experimental group in the Winter term. Each of these three new subjects received one hour of individual therapy per week and met together with their clinician for one hour of group therapy per week. The therapy

received during the Spring term by the nine Experimental group subjects who had begun therapy in January is described below.

I. Review Motor Planning

Since approximately three weeks elapsed between the cessation of therapy in the Winter term and its resumption in the Spring term, the clinician reviewed with each subject how much work had been done and its outcome during the three-week period.

II. Exaggerated Stress and Retelling of Stories

Both of these techniques are taken from the book by Weiss (1964) on cluttering. Although they are described by him for the treatment of cluttering - and not for stuttering per se, they seemed to the present writer to have some relation to motor planning and, so, were used with the Experimental group.

With reference to exaggerated stress, Weiss said:

> Exaggerated accentuation is one of the most incisive approaches we have found in the treatment of cluttering. It consists of placing an exaggerated stress on every accentuated syllable, e.g., YESterday I MET a VERy GOOD FRIEND in TOWN and we HAD a GOOD TIme toGETHer. (1964, p. 89)
>
> Patients consistently report the efficacy of these procedures in formulating sentences. An intelligent, fifteen-year-old boy said: "When I hit the accents hard, the whole sentence clears up in my mind." This would indicate that timing is important not only for actual delivery, but for the inner formulation of the sentence as well. The sharply emphasized accents seem to form a mold which gives the sentence about to be pronounced a clear outer contour. This mold seems

> to create an "active void" which wants to be filled and seems to draw in the words necessary to fill the form. Many patients report that if they "hit the accents hard" the necessary words occur to them more easily. (1964, pp. 89-90)

In retelling stories, the subject's task was to repeat in his own words a story, anecdote, or joke which had just been told to him by the therapist, in such a way that the main point of the story emerged clearly from the various events of the story. Weiss said:

> In his narration it is important that the patient try to formulate the sentence before verbalizing it. This will be difficult at first. Some patients simply state that they are completely incapable of planning a whole sentence before hand. They should be encouraged to try, however, using any method which is least difficult for them. The choice of method will depend upon the patient's predominant type of imagery. Some will move their lips silently (motor type), others "hear" the words (auditory type), and still others will "see" what they are about to describe or even "see" the sentence in writing (visual type). (1964, pp. 94-95)

III. On-Goingness and the Feeling of Fluency

It was pointed out that a great deal of the speech of stutterers is fluent; however, few stutterers are aware of the characteristics of this fluency. The subjects were asked to attend to the feeling, the sound, and the visual appearance of their own fluency and use these observations of fluency to help them recreate the fluency in their motor planning. An attempt was made to provide and point out situations in which fluency occurred for substantial lengths of time. In group sessions, the subjects

participated in choral reading exercises during which they were to attend to and attempt to describe the characteristics of their fluency. They were encouraged to speak aloud when alone since most of them did not stutter in this situation. They were also asked to read aloud, track the speech of a radio or television announcer, and speak to themselves while looking into a mirror in order to obtain and observe the moments of fluency.

Several techniques were employed to create an awareness of the characteristics of fluency. One of the most helpful of these was the explanation of fluency as a feeling of on-goingness and motion. The subjects were shown that, in moments of fluency, the articulators moved easily from one sound to another without disruption. It was suggested that this continued motion was one aspect of fluency which the subjects could attempt to recreate in their conscious motor planning and they were encouraged to do so.

IV. Pre-Writing in Phrases

When motor planning speech in phrases was introduced, several subjects reported that it was very difficult for them to motor plan an entire phrase. Some said that they could not motor plan for a unit as long as a phrase. Others claimed that they could not "think what they were going to say" and motor plan at the same time. A way to overcome both these objections was to have the subjects write out their answers to questions posed by the clini-

cian. In some cases, the written answer seemed to elicit a visual image of the words which the subjects employed directly in the motor plan; however, in most cases, the written phrase simply helped the subjects to know exactly what they were about to say.

V. Motor Plan Through Words and Phrases

Early in the Winter Term, the subjects were taught to motor plan single word answers in non-spontaneous speech before uttering them. Here, the subjects were taught to motor plan through words and phrases on which stuttering was anticipated in spontaneous speech. The subjects were told to stop before a word or phrase on which they anticipated stuttering and to plan out the motor act of speech for that unit of speech before it was spoken.

VI. Conventional Therapy

Essentially, the conventional therapy for this group during the Spring term was an extension and elaboration of the approaches used in the Winter term. Specifically, the attempt was made to have the subjects become more proficient in the elimination of any secondary symptoms and the use of controls such as the stop-go, cancellation, and pull-out. Work was continued to help the subjects improve their relevant attitudes toward their stuttering.

Control Group - Spring Term

The three new subjects who were added to the Control group in the Spring term received therapy as described

above for the Control group in the Winter term. The therapy for the eight subjects in the Control group who had entered the study in January is described below. (It should be remembered that the ninth of the original Control group subjects, #C3, withdrew from therapy at the end of the Winter term.)

I. Review of Work Done During Winter Term

II. Encourage a More Diligent Attention to Improvement of Stuttering

The subjects in this group (and in the Experimental group) seemed to need some fairly direct work in the direction of increasing their degree of motivation at around this time. This relative lack of enthusiasm seemed to be a function of a general sluggishness in resuming the academic pace after a several-week vacation. In addition, the subjects seemed to need some spurring on in order to be willing to attempt to master their stuttering in the more difficult situations rather than being content to settle for those gains which they had accomplished to date.

III. Continued Work to Improve Eliminating Secondaries and Use of Controls

IV. Introduction of the Control of Preparatory Set

This control was also a creation of Van Riper (1963). It depends in part on the ability of the subject to anticipate stuttering on a given word. When the subject does anticipate stuttering on a word, he is trained to stop

immediately before that word, pause while he analyzes how he would have stuttered if he had gone right into the speaking attempt, and plan how he will say the word when he does make the speech attempt; finally, he does then say the word aloud in the planned way.

V. Using Controls on Faked Stuttering

Because a number of the subjects were experiencing a considerable amount of fluency, they were having insufficient opportunity to get the further practice which they needed in the use of controls. To meet this problem, such subjects were encouraged to fake stuttering fairly often on words so as to have these words as opportunities to practice the various controls.

VI. Attitudes

During the second half of the Spring term, in both individual and group therapy, time was given to an evaluation of the efforts of the subjects in therapy, including the degree of their personal involvement in therapy. Such sessions included discussion in a more detailed manner than previously of maintaining causes of stuttering, the merits, pro and con, of attempting to speak in what had always been very difficult situations for the individual, and how these subjects could continue to work on their stuttering over the course of the summer even though they would not be enrolled at the University during that time.

ANALYSES OF THE DATA AND FINDINGS

Test-Retest Consistency of Judgments

As described above, each of the three judges at the University of Pittsburgh listened to and made severity judgments on all of the 65 tapes. Having done so, they immediately rated 14 of these tapes a second time in order to provide data to determine the test-retest consistency of their judgments. The Spearman rank order correlations based on these data are shown in Table 2. As may be noted in Table 2, all these correlations are quite high; indeed, except for the correlation for frequency in Spontaneous, all of the correlations are .92 or higher. All ten of these correlations are significantly different from zero at beyond the 1% level, indicating that the judges were highly consistent in their judgments.

Analysis of Between-Group Differences for the Eighteen Subjects who Entered Study at Beginning

It will be recalled that nine subjects were in the Experimental group throughout the entire study and data were collected upon them at the first (January), middle (March), and final (May) testing periods. In the Control group, nine subjects took part in the study throughout the Winter term and data were collected upon them at the first and middle testing periods; however, since one of these subjects dropped out of therapy at the end of the Winter

Table 2. Spearman rank-order correlations for test-retest consistency of judgments.

		Correlation
Spontaneous	F	.89**
	T	.95**
	D	.93**
	C	.92**
	M	.95**
Reading Aprosexia	F	.95**
	T	.93**
	D	.97**
	C	.94**
	M	.94**

** Significant at the 1% level

F = frequency, T = tension, D = duration, C = complexity, M = median of first four

term, data were collected on only the remaining eight subjects at the final testing period. Only the data for the 18 subjects who entered the study at its beginning were used in the formal statistical analysis. Data on the six subjects who entered the study at the midpoint were analyzed by inspection only and the results of this analysis are shown below under the heading Analysis by Inspection of Data for Six Subjects Who Entered Study at Midpoint.

Self-Ratings. The means for each of the fifteen measures used in the study for each group at each of the three testing periods are shown in Table 3.[3] Considering first the means for the Stutterer's Self-Ratings of Reactions to Speech Situations (hereafter called Self-Ratings), it may be seen in Table 3 that the Experimental subjects showed relatively little change over the course of the five month period of the study. This trend is shown in the Median ratings for the Experimental group where the mean change was from 3.00 to 2.50. The Control group likewise showed relatively little change over the course of the entire study period as illustrated by the fact that the means under the heading of Median changed only from 2.44 to 2.19. It should be noted that the members of the Control group showed no improvement in

[3]It should be recalled that the scores for the Stutterer's Self-Ratings of Reactions to Speech Situations are based on a five-point scale while the overt severity ratings for Spontaneous and Reading are based on a seven-point scale.

Table 3. Mean scores for experimental (N=9) and control (N=9)* groups on Self-Ratings, Spontaneous, and Reading at each of three testing times.

		Experimental			Control		
		First	Middle	Final	First	Middle	Final
Self-Ratings	A	2.39	2.39	2.05	1.72	1.62	1.62
	R	2.76	2.39	2.11	2.27	2.25	2.12
	S	3.00	2.88	2.83	2.61	2.62	2.25
	F	4.66	4.72	4.16	4.77	4.75	4.62
	M	3.00	2.72	2.50	2.44	2.44	2.19
Spontaneous	F	5.22	4.77	3.88	4.88	4.11	3.37
	T	3.44	3.66	3.00	4.00	3.55	2.25
	D	3.11	3.22	2.44	3.22	3.00	2.12
	C	3.66	3.55	2.66	4.00	3.44	2.75
	M	3.61	3.77	2.83	4.00	3.44	2.44
Reading	F	4.33	4.33	3.22	3.56	3.55	2.75
	T	3.22	3.88	2.77	3.11	3.33	2.37
	D	2.44	2.77	1.88	2.66	3.22	2.12
	C	2.77	3.33	1.88	3.22	3.11	2.50
	M	3.00	3.61	2.21	3.16	3.28	2.37

A - avoidance, R - reaction, S - stuttering,
F - frequency of meeting situation

*N=8 for Control group at Final because Subject C3 withdrew from therapy at midpoint of study.

Self-Ratings between the first and middle testing periods as indicated by almost identical scores at the latter point on all five of the aspects of the Self-Ratings inventory; the group consistently showed a lower rating at the final period than at the middle, indicating a slight change in the direction of more favorable self-ratings over the course of this period.

In Table 4 are shown the mean difference scores and the values of t[4] showing the significance of the difference between each pair of mean difference scores. For example, in the first-middle comparison, the Experimental group showed a mean difference score on Avoidance of zero, while the mean difference score for the Control group for Avoidance was -.07; the t for this pair of mean difference scores was 0.244, which fell far short of statistical significance. (A value of t of 2.120 was needed for significance at the 5% level.) As seen in Table 4, only one of the t values shown there was significant, namely, the value of 2.280 for Frequency in the middle-final comparison was significant at the 5% level.

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[4]The t formula for uncorrelated measures was used in this study whenever any between-group comparisons were made because the two groups were not matched closely enough. In Table 1, the mean ratings for Spontaneous and Reading in the Experimental group were .44 and .27 higher than in the Control group; however, Table 3 shows that the three judges at Pitt yielded an opposite pattern in that the mean ratings for Spontaneous and Reading in the Control group were .39 and .16 higher than in the Experimental group. Although these differences are not large, it was felt that the conservative course would be to use the formula for uncorrelated measures.

Table 4. Mean difference scores and t-ratios on Self-Ratings for experimental (N=9) and control (N=9)# groups for each of three comparison periods.

		Experimental	Control	t
First-Middle	A	0	-.07	0.244
	R	-.37	-.06	1.395
	S	-.12	-.07	0.918
	F	.06	-.25	1.078
	M	-.28	-.06	1.219
Middle-Final	A	-.34	0	1.512
	R	-.28	0	1.096
	S	-.05	-.29	0.594
	F	-.56	.07	2.280*
	M	-.22	-.15	0.397
First-Final	A	-.34	-.07	0.717
	R	-.65	-.07	1.891
	S	-.17	-.31	0.445
	F	-.50	-.13	1.325
	M	-.50	-.18	1.403

* Significant at 5% level

N=8 for Control group in First-Middle comparison because Self-Ratings data were not collected for Subject C2 at Middle due to an oversight. For the same reason, the mean difference scores for Control at First-Middle are based only on eight subjects with scores for Subject C2 excluded (see Table 7).

Severity Ratings Based on Spontaneous Speech. Referring again to Table 3, the means shown there for each aspect of the Spontaneous speaking performance for each group reveal some interesting similarities in the pattern of change. In the first-middle period, the means for the Experimental group decreased only slightly or even increased during this period. This is shown perhaps most clearly by the fact that the mean for the Median rating increased from 3.61 to 3.77. However, during the middle-final period, the Experimental group decreased on the average of almost one full scale point as shown by the decrease in the mean rating for Median from 3.77 to 2.83.

The subjects in the Control group show what might be called a similar pattern of change during the full study period. During the first-middle portion of the study, the Control group decreased somewhat more than one-half scale point on the average as exemplified by the fact that the mean for Median decreased from 4.00 to 3.44. Then, during the middle-final portion of the study, the Control group decreased by one full scale point, as shown by the decrease in the mean for Median from 3.44 to 2.44.

In Table 5 are shown the mean difference scores and values of *t* for the Spontaneous ratings for each of the three comparison periods. As shown in Table 5, for none of the three comparison periods including the first-final were any of the *t*-values significant, indicating that the

Table 5. Mean difference scores and t-ratios on Spontaneous for experimental (N=9) and control (N=9)* groups for each of three comparison periods.

		Experimental	Control	t
First-Middle	F	-.45	-.77	0.478
	T	.22	-.45	0.946
	D	.11	-.22	0.469
	C	-.11	-.56	0.549
	M	.16	-.56	1.033
Middle-Final	F	-.89	-.38	0.848
	T	-.66	-1.12	0.525
	D	-.78	-.75	0.037
	C	-.89	-.50	0.407
	M	-.94	-.81	0.156
First-Final	F	-1.34	-1.25	0.087
	T	-.44	-1.62	1.272
	D	-.67	-1.13	0.359
	C	-1.00	-1.12	0.000
	M	-.78	-1.43	1.479

*N=8 for Control group at Middle-Final and First-Final because data for Subject C3 were excluded inasmuch as he was not in study at Final testing.

Experimental group did not show a greater reduction in severity than the Control group.

Severity Ratings Based on Reading Aloud. Referring again to Table 3 (p. 44), it may be seen there that the means for the Experimental group showed the same pattern of change for Reading as they had for Spontaneous and to a greater extent, that is, the means increased during the first-middle period as exemplified by the increase in the mean for Median from 3.00 to 3.61. Then, during the middle-final period, the means showed a substantial decrease as exemplified by the change in the mean for Median from 3.61 to 2.21. Of course, the extent of the latter change is in large measure an artifact of the increase during the first-middle period. This is shown clearly when one sees that the decrease during first-final was only from 3.00 to 2.21. The Control group did not show the same relatively large decrease during first-middle and even larger decrease during middle-final that it showed for Spontaneous. Rather, there was little change during first-middle but then a relatively large decrease occurred during middle-final.

In Table 6 are shown the mean difference scores and values of *t* for each of the five aspects of the Reading situation for each of the three comparison periods. All the values of *t* are seen to fall far short of the value needed for significance, again indicating that the Experimental group did now show a greater reduction in severity

Table 6. Mean difference scores and t-ratios on Reading for experimental (N=9) and control (N=9)* groups for each of three comparison periods.

		Experimental	Control	t
First-Middle	P	0	-.01	0.000
	T	.66	.22	0.632
	D	.33	.56	0.297
	C	.56	-.11	0.824
	M	.61	.12	0.704
Middle-Final	P	-1.11	-.37	1.228
	T	-1.11	-.88	0.327
	D	-.89	-1.00	0.170
	C	-1.45	-.50	1.112
	M	-1.39	-.82	0.735
First-Final	P	-1.11	-.50	0.669
	T	-.45	-.63	0.245
	D	-.56	-.50	0.096
	C	-.89	-.62	0.321
	M	-.78	-.69	0.053

*N=8 for Control group at Middle-Final and First-Final because data for Subject C3 were excluded inasmuch as he was not in study at Final testing.

than the Control group.

Within-Group Changes During Each of the Comparison Periods

In the three sections immediately above, the between-group comparisons showed that the 18 Experimental group subjects did not show a greater reduction in the severity of stuttering than the 18 Control group subjects. Another kind of analysis which bears on the basic question of the study is to compare the direction and significance of within-group differences in the Experimental and Control groups. The means for each group and values of t are shown for each comparison period in Tables 7, 8, and 9. In Table 7, which presents the data for the first-middle comparison period, it may be seen that only one t value was significant for either group. This is not surprising for the Experimental group, because it will be remembered that this group showed a small increase in mean values during this period for both the Spontaneous and Reading situations. On the other hand, the Control group showed a moderate decrease during this period in the Spontaneous situation, but nonetheless none of the values of t for Spontaneous were significant. In Table 8 where the date are shown for the middle-final period, it may be seen that three of the values of t are significant for the Experimental group, but none are significant for the Control group. The t value of 2.443 for Frequency under Self-Ratings is based on a mean difference of only .56, which would seem to be a rather small change. However, the other two values of t, both

Table 7. Means and t-ratios for experimental (N=9) and control (N=9)# groups on Self-Ratings, Spontaneous, and Reading for first-middle comparison period.

		Experimental			Control		
		First	Middle	t	First	Middle	t
Self-Ratings	A	2.39	2.39	0.000	1.69	1.62	1.000
	R	2.76	2.39	1.673	2.31	2.25	1.000
	S	3.00	2.88	1.000	2.69	2.62	0.261
	F	4.66	4.72	0.263	5.00	4.75	1.528
	M	3.00	2.72	2.294*	2.50	2.44	0.424
Spontaneous	F	5.22	4.77	1.315	4.88	4.11	1.257
	T	3.44	3.66	0.426	4.00	3.55	0.936
	D	3.11	3.22	0.229	3.22	3.00	0.426
	C	3.66	3.55	0.182	4.00	3.44	1.048
	M	3.61	3.77	0.320	4.00	3.44	1.189
Reading	F	4.33	4.33	0.000	3.56	3.55	0.000
	T	3.22	3.88	1.206	3.11	3.33	0.512
	D	2.44	2.77	0.756	2.66	3.22	0.921
	C	2.77	3.33	0.783	3.22	3.11	0.286
	M	3.00	3.61	1.039	3.16	3.28	0.279

* Significant at 5% level.

\# N=8 for Control group on Self-Ratings because data for Subject C2 were not included (see Table 4).

Table 8. Means and t-ratios for experimental (N=9) and control (N=9)# groups on Self-Ratings, Spontaneous, and Reading for middle-final comparison period.

		Experimental			Control		
		Middle	Final	t	Middle	Final	t
Self-Ratings	A	2.39	2.05	1.512	1.57	1.57	0.000
	R	2.39	2.11	1.644	2.14	2.14	0.000
	S	2.88	2.83	0.263	2.57	2.28	1.000
	F	4.72	4.16	2.443*	4.71	4.78	0.420
	M	2.72	2.50	1.180	2.36	2.21	0.795
Spontaneous	F	4.77	3.88	1.735	3.75	3.37	1.158
	T	3.66	3.00	1.069	3.37	2.25	1.843
	D	3.22	2.44	1.421	2.87	2.12	1.426
	C	3.55	2.66	1.037	3.25	2.75	1.183
	M	3.77	2.83	1.380	3.25	2.44	1.627
Reading	F	4.33	3.22	2.063	3.12	2.75	1.426
	T	3.88	2.77	2.063	3.25	2.37	1.825
	D	2.77	1.88	2.101	3.12	2.12	2.000
	C	3.33	1.88	2.393*	3.00	2.50	0.837
	M	3.61	2.22	2.562*	3.19	2.37	1.688

* Significant at 5% level.

\# N=8 for Control group because data for Subject C3 were not included. The means for Control for Self-Ratings at Middle and Final, for Spontaneous at Middle, and for Reading at Middle do not agree with those shown in Table 3 because of the different N.

Table 9. Means and t-ratios for experimental (N=9) and control (N=9)# groups on Self-Ratings, Spontaneous, and Reading for first-final comparison period.

		Experimental			Control		
		First	Final	t	First	Final	t
Self-Ratings	A	2.39	2.05	0.894	1.69	1.62	1.000
	R	2.76	2.11	2.667*	2.19	2.12	0.314
	S	3.00	2.83	1.000	2.56	2.25	1.106
	F	4.66	4.16	2.121*	4.75	4.62	0.798
	M	3.00	2.50	2.000	2.37	2.19	0.893
Spontaneous	F	5.22	3.88	2.530*	4.62	3.37	1.570
	T	3.44	3.00	0.736	3.87	2.25	2.303*
	D	3.11	2.44	0.970	3.25	2.12	1.688
	C	3.66	2.66	1.604	3.87	2.75	1.843
	M	3.61	2.83	1.360	3.87	2.44	2.186*
Reading	F	4.33	3.22	3.162*	3.25	2.75	1.080
	T	3.22	2.77	0.936	3.00	2.37	1.106
	D	2.44	1.88	1.890	2.62	2.12	1.000
	C	2.77	1.88	2.101	3.12	2.50	0.886
	M	3.00	2.22	1.933	3.06	2.37	1.231

* Significant at 5% level.

\# N=8 for Control group because data for Subject C3 were not included. Means for Control group at First testing are different from those in Table 3 because of different N.

of which were found for certain aspects of the Reading situation are based on mean difference scores of approximately 1.4, which would seem to be of more consequence. In Table 9, where the data are shown for the first-final comparison period, it may be seen that four of the *t* values for the Experimental group were significant at the 5% level, and two of the *t* values for the Control group were significant. Here again, the *t* values for Reaction and Frequency under Self-Ratings are based on mean differences of only .65 and .50 whereas the other two are based on mean differences of 1.34 and 1.11. The significant *t*'s for the Control group are based on differences of 1.62 and 1.43.

Analysis by Inspection of Data for Six Subjects Who Entered Study at Midpoint

Data for the six subjects who entered the study at its midpoint were not included in the formal statistical analysis summarized above in Tables 3 through 9 because to do so would have confounded their data with data for the 18 subjects who had already received one full term of therapy. With only three new subjects in each group, no formal comparison of group differences could be made so an inspectional analysis only is given below.

The means for each of the fifteen measures used in the study for each group of three subjects at each of the two testing periods are shown in Table 10. Considering

Table 10. Mean scores for experimental (N=3) and control (N=3) groups on self-ratings, spontaneous, and reading at each of two testing times.

		Experimental		Control	
		Middle	Final	Middle	Final
Self-Ratings	A	1.50	2.16	2.33	2.00
	R	2.00	2.33	2.66	2.66
	S	2.50	2.66	2.66	3.00
	F	5.00	5.00	4.66	4.66
	M	2.25	2.50	2.66	2.83
Spontaneous	F	6.00	3.00	5.33	4.66
	T	3.66	2.00	3.66	3.33
	D	3.33	1.66	3.66	2.66
	C	5.00	2.00	3.33	2.66
	M	4.33	2.00	3.33	3.16
Reading	F	4.00	3.33	2.66	2.33
	T	3.00	2.00	2.33	2.33
	D	3.33	1.33	1.33	1.33
	C	3.66	2.33	2.00	2.00
	M	3.16	2.16	2.16	1.83

first the means for Self-Ratings, it may be seen that both groups showed a change in the direction of less favorable self-ratings between the two testing periods as indicated by a higher score on the Median rating in both groups at the final testing. Looking next at the means for Spontaneous, the Experimental group showed much larger decreases on all five measures than the Control group as exemplified by a decrease of 2.33 in the mean for Median in the Experimental group as compared to a decrease of only .17 for the Control group. A similar finding, though not of such large magnitude, was present in the five means for Reading where there was a decrease of 1.00 in Median for the Experimental group as compared to a decrease of only .33 for the Control group.

Subjective Impressions of Progress of Subjects

In general, the subjects in the Experimental group seemed to understand the motor planning techniques and were able to apply them. However, three of the techniques did prove to be somewhat difficult to learn and/or to apply. The first difficulty occurred when the subjects were asked to evolve a better motor plan so as to say a word fluently after having predicted stuttering on the word and analyzed the deficiencies in their motor plan for that word. Subjects frequently reported an increase of general tension when attempting to achieve this goal. It would seem that this technique was introduced somewhat too soon in the therapy sequence and probably would have

been mastered much more easily if left to a later point in the therapy program. The problem was by no means a permanent one for any of the subjects and, at a somewhat later time, they were able to achieve this goal and it was found to be one of the more successful of any of the motor planning techniques. The second technique with which difficulty was experienced involved the "tracking" of a previously made fluent recording. Several of the Experimental group subjects reported that they were unable to attend to their fluency because of difficulty in repeating what was heard on the recording no more than a syllable or word behind the recording. This was not a problem for all the subjects and even some of those for whom it was a problem were able to attend to their fluency if they were permitted to repeat a phrase at a time of their own recorded fluent speech. Thirdly, the technique of using exaggerated stress did not seem to be beneficial for any of the Experimental group subjects. In fact, the more severe subjects experienced more frequent stuttering while using this technique and their secondary symptoms were found to increase in severity as well.

Certain differences were noted between the severe subjects in the Experimental group and the moderate or mild subjects in the Experimental group. The severe subjects had more frequent absences from therapy, had little success with either exaggerated stress or the retelling of stories, had less trouble predicting moments of stutter-

ing, were better able to describe the cues which indicated to them that they might stutter on an approaching word, and needed more time to find success as new motor planning techniques were presented to them. The moderate and mild subjects were absent less often than the severe subjects, failed more often to complete assignments given to them, responded more quickly when new motor planning techniques were presented to them, offered more suggestions and commented more freely about the motor planning therapy, and the mild stutterer was more apt to try new motor planning techniques on his own without their being formally assigned than were either the moderate or severe subjects.

There did not seem to be any differences in motivation between the Experimental and Control groups. Although there were slightly more absences among the members of the Experimental group than the Control group, on the whole both groups responded with about the same degree of enthusiasm to their particular therapy program.

The use of motor planning techniques with the Experimental group seemed neither to facilitate nor hinder the conventional therapy techniques also used with the Experimental group. With all the conventional therapy techniques such as working directly to eliminate secondary symptoms and the use of cancellation, pull-out, and preparatory set, the Experimental group subjects used the techniques with the same degree of success as did the subjects in the Control group.

CONCLUSIONS AND IMPLICATIONS

It will be recalled that the purpose of the present study was to test the hypothesis that a group of stutterers who were trained to use motor planning techniques in addition to receiving conventional therapy would show a greater reduction in the severity of their stuttering than a matched group of stutterers who received conventional therapy only. Between-group comparisons based on the data for the 18 subjects who entered the study at its beginning revealed that this hypothesis was not supported because the subjects in the Experimental group did not show a greater reduction of severity of stuttering than the subjects in the Control group. On the other hand, within-group comparisons of the data for these same 18 subjects revealed that the Experimental group showed significant decreases in eight out of thirty comparisons for the middle-final and first-final comparison periods, while the Control group showed two significant decreases on the same thirty comparisons. Although the outcome would have been more clear-cut if both the between-group and within-group comparisons were significant, the fact that several of the within-group comparisons were significant does: 1) indicate that the Experimental group made a greater reduction in severity of stuttering than the Control group, and 2) permit the tentative conclusion that the motor planning techniques were the reason for the greater improvement of

the Experimental group.

A factor which might further qualify the lack of significant between-group differences stems from the finding that the severity ratings for the nine original Experimental subjects were higher at the middle testing session than at the first testing session, indicating that their stuttering was more severe at the middle testing session. Two possible reasons may be advanced for this occurrence: first, subjects in the Experimental group might have been confused by being given both conventional therapy and training in motor planning during this period; another possibility is that the increase in severity might have been the result of the lack of skill of the principal investigator and the three clinicians in training the subjects in the use of the motor planning techniques. Whichever reason was operating, the severity level of the subjects in the Experimental group was increased thereby rendering it most unlikely that the Experimental group would have a greater reduction in severity of stuttering than the Control group. So, it is suggested that the finding of no significant between-group differences was an artifact rather than the result of a lack of worthwhileness of the motor planning techniques.

Although only six subjects entered the study at its midpoint, the inspectional analysis of the data for these subjects seems to show quite clearly that the Experimental subjects experienced a markedly greater reduction in

severity of stuttering than the Control subjects. This finding seems to give further support to the tentative conclusion that the motor planning techniques did underlie the greater reduction in severity of the Experimental group. In addition, this finding seems to support the dual possibility that: 1) the nine original Experimental subjects increased in severity between the first and middle testing sessions because of a lack of skill in teaching on the part of the professional personnel, and 2) that the professional personnel improved in skill over the course of the first half of the study and, therefore, were able to provide efficient training in motor planning for the three new Experimental subjects during the second half of the study..

Within the limits of the present study, it seems defensible to conclude that:

1) A group of stutterers who were trained to use motor planning techniques in addition to receiving conventional therapy did show a greater reduction in the severity of their stuttering than a matched group of stutterers who received conventional therapy only.

2) The motor planning techniques developed for use in this study can be used to help young adult stutterers form, construct, evolve motor plans despite the presence

of anticipation-anxiety and, therefore, constitute a set of therapy procedures which can be drawn upon by professional workers.

In view of the relatively small sample of subjects in the present study and the lack of significant between-group differences, these conclusions should be regarded as tentative ones pending confirmation of the findings by further studies.

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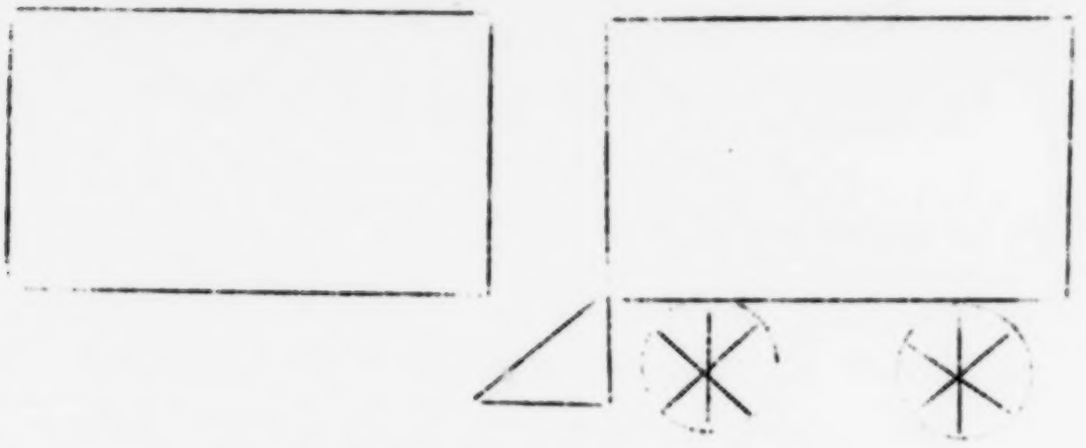
APPENDIX A

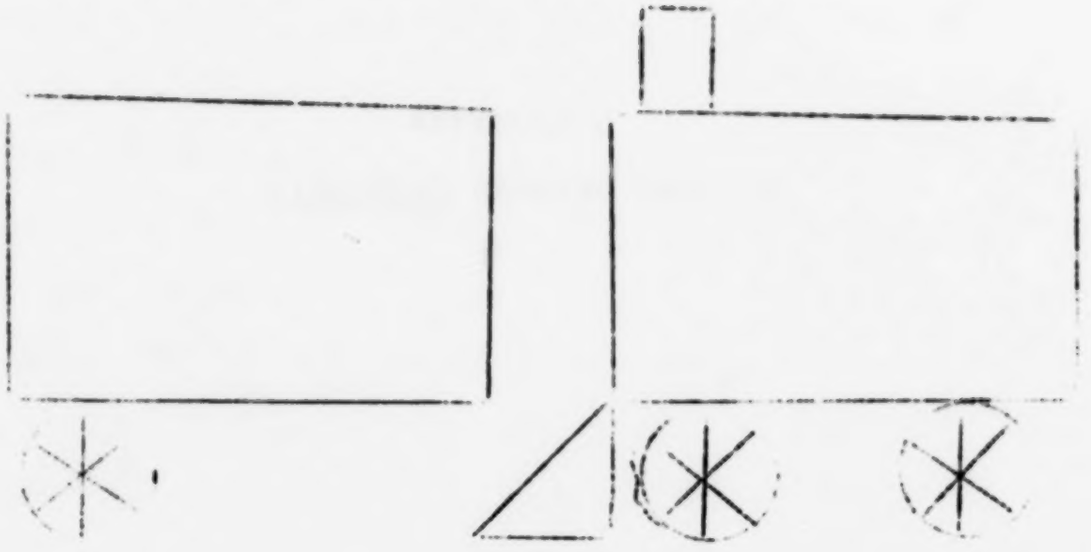
INSTRUCTIONS READ TO SUBJECTS TO OBTAIN SAMPLES OF SPONTANEOUS SPEECH

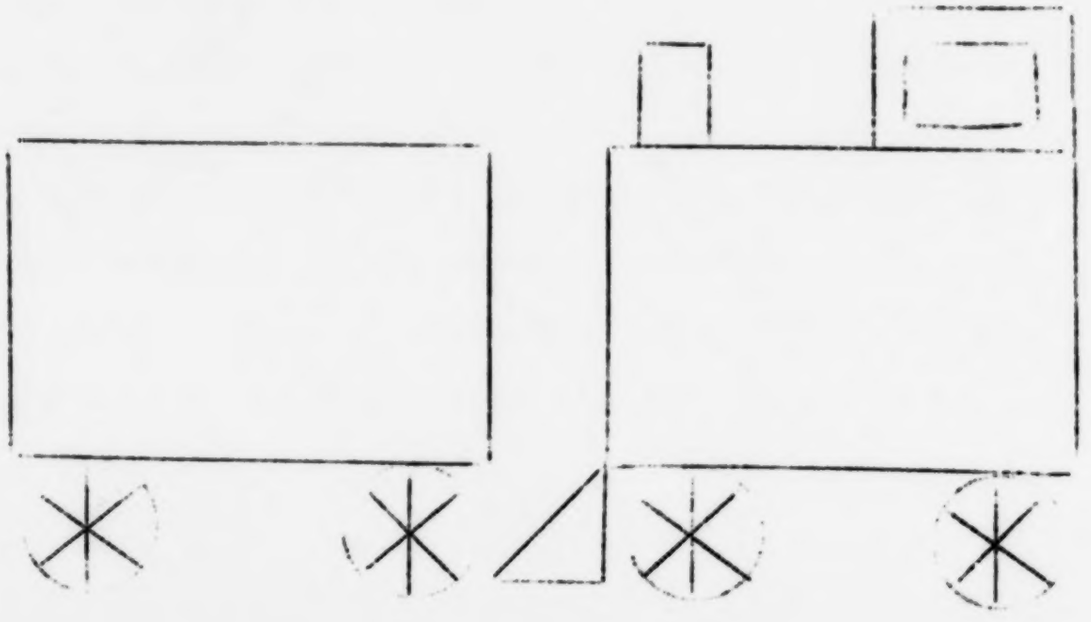
We are conducting a study to determine how much information is conveyed by the speech of persons with different speech problems. I am going to ask you to describe a series of sketches and your descriptions will be tape recorded. This recording will be played to a group of persons who will attempt to reproduce as exactly as possible the sketches you describe. So, please describe each sketch in such a way that someone hearing the recording could make a drawing which will look exactly the same as each sketch. Make your description as clear and detailed as possible, and talk as uninterruptedly as possible. Do you have any questions?

APPENDIX B

FIRST SET OF LINE DRAWINGS







APPENDIX C

LIGHTNING READING PASSAGE

I am taking part in a study to learn more about stuttering. We are doing this in the Speech and Hearing Clinic in the sub-basement of the Sparks Building.

Over the years man has learned how lightning strokes are formed. To begin with, a thunderhead gets under way when warm, humid air rises from the earth in a long updraft, generally above a hill or mountaintop. The humidity condenses as the moist air cools in rising. We see many tiny water droplets as mist which soon assumes the well known form of a huge thunderhead. Sometimes resembling huge cauliflowers, sometimes enormous white anvils, thunderheads are often topped by a big "circus umbrella." They are composed of many minute ice crystals.

These formations can be enormous--up to fifty thousand feet in height. They may contain as much as three hundred thousand tons of water. In them is a so-called "chimney current"--a big air column that rises at full gale force of about one hundred feet a second. The moisture in this big column condenses fast, and many droplets are soon swept upward to form into heavy hailstones. The hailstones do not fall now. They dance on the current like celluloid balls on a water fountain, rising increasingly higher until, near the cloud top, the current's force is exhausted. There the large hailstones fall in all directions towards earth.

APPENDIX D

INSTRUCTIONS FOR RATING SEVERITY OF STUTTERING

FREQUENCY

1. stuttering on less than 1 per cent of words
2. stuttering on 1 to 2 per cent of words
3. stuttering on about 2 to 5 per cent of words
4. stuttering on about 5 to 8 per cent of words
5. stuttering on about 8 to 12 per cent of words
6. stuttering on about 12 to 25 per cent of words
7. stuttering on more than 25 per cent of words

TENSION

1. very little tension
2. tension scarcely perceptible
3. tension noticeable but not very distracting
4. tension occasionally distracting
5. consistently noticeable tension
6. conspicuous tension
7. very conspicuous tension

DURATION

1. blocks less than one second in duration
2. very few, if any, blocks last as long as a full second
3. most blocks do not last longer than one full second
4. blocks average about one second in duration
5. blocks average about two seconds in duration
6. blocks average 3 to 4 seconds in duration
7. blocks average more than 4 seconds in duration

PATTERN COMPLEXITY

1. patterns of blocks absolutely uncomplicated with no distracting sounds
2. patterns of blocks simple with no distracting sounds
3. patterns of blocks mostly simple with no distracting sounds
4. blocks characterized by a few distracting sounds
5. moderately frequent distracting sounds
6. frequent distracting sounds
7. very frequent distracting sounds

APPENDIX E

RATING SHEET

Judge's Name _____ Date _____

Subj.	Spontaneous F	Spontaneous T	Spontaneous D	Spontaneous C	Reading F	Reading T	Reading D	Reading C
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
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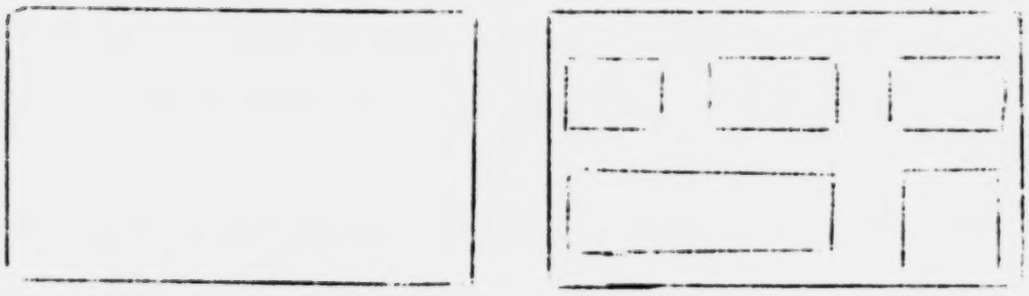
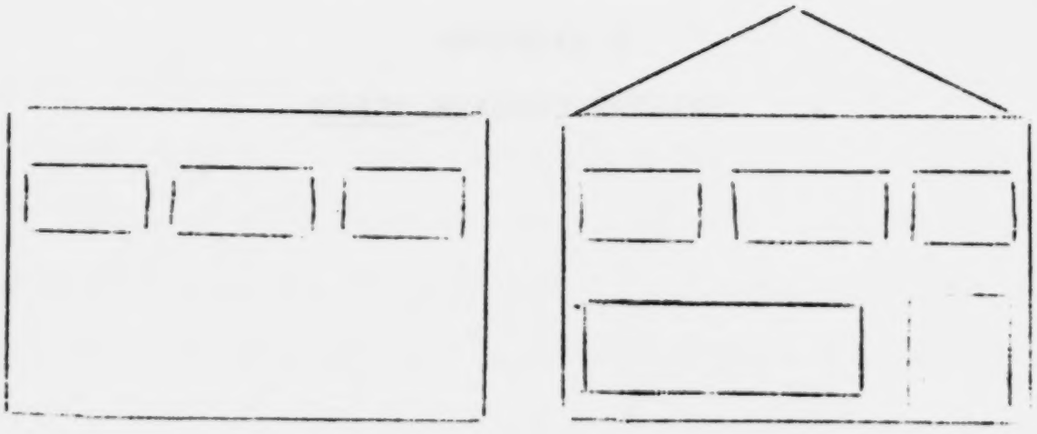
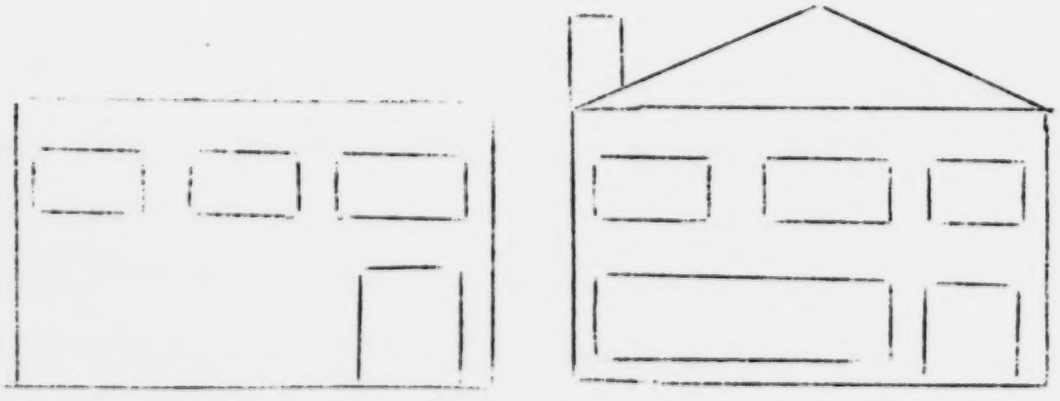
APPENDIX F

SECOND SET OF LINE DRAWINGS







APPENDIX G

GLASS READING PASSAGE

I am taking part in a study to learn more about stuttering. We are doing this in the Speech and Hearing Clinic in the sub-basement of the Sparks Building.

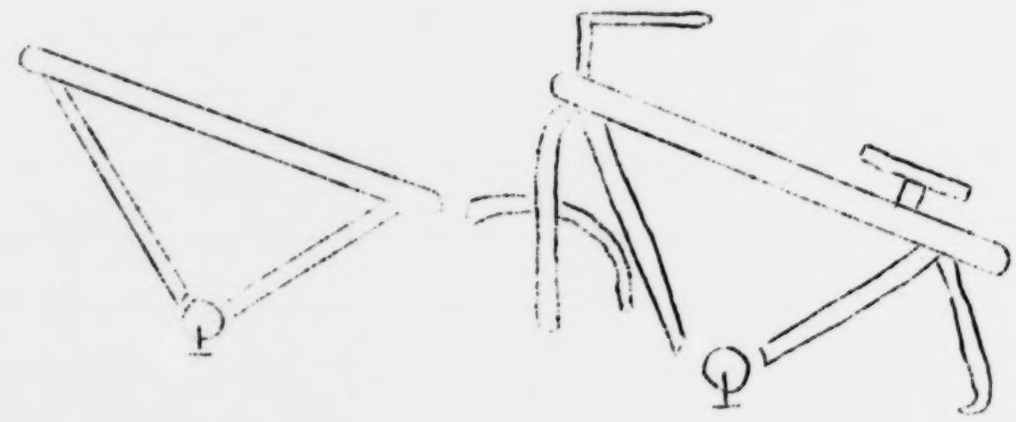
A diamond weighing a pound may cost a million dollars, while a pound of glass may cost less than twenty cents. Yet measured in terms of the value to the human race, glass is one of the most important materials we have, and is worth far more than any rare gem ever discovered. When the physicist and the chemist have finished discovering all the many kinds of glass that can be made, it will be worth even more.

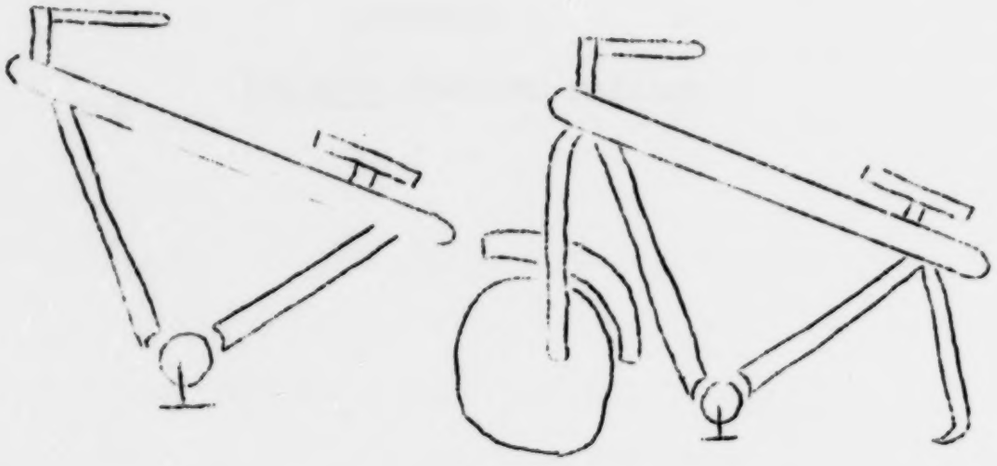
Glass, before science took it in hand, was just glass. Now it has been developed in dozens of new forms and endowed with a hundred new talents. Tough glasses which retard the flow of heat are made into bricks and many implements. Resistant glasses are molded into vacuum tubes and insulators. New and surprising varieties of glass show unexpected abilities when shaped into frying pans, fireproof cloth, and even into springboards for diving pools.

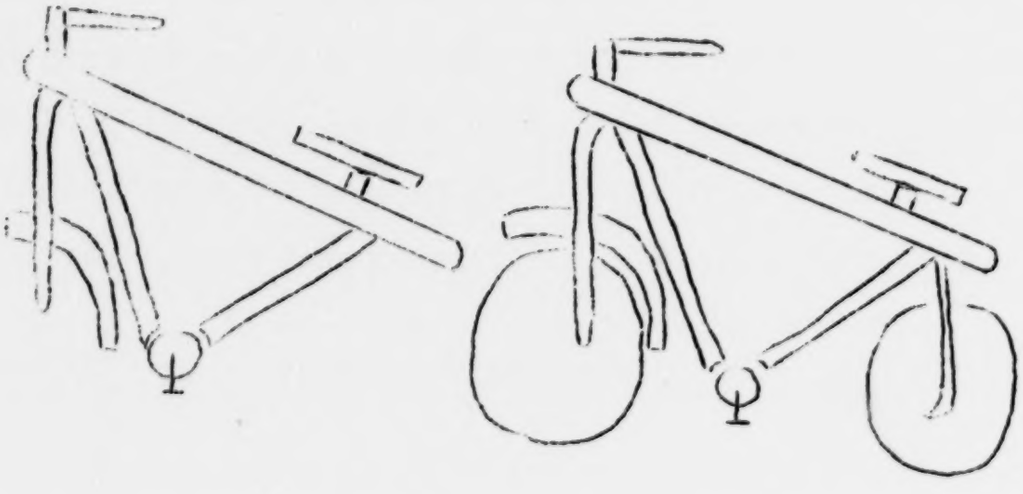
An inch cube of glass is so strong that it can support a heavily loaded freight car, though such a task would strain a similar cube of almost any other material. A glass window only one inch thick can be made so that it will stop a bullet.

APPENDIX H

THIRD SET OF LINE DRAWINGS







APPENDIX I

RAINBOW READING PASSAGE

I am taking part in a study to learn more about stuttering. We are doing this in the Speech and Hearing Clinic in the sub-basement of the Sparks Building.

When the sunlight strikes raindrops in the atmosphere, they act like a prism and form a rainbow. The rainbow is a division of white light into various beautiful colors. These take the shape of a long round arch, with its path towering above, and its two extremities apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no human ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

Throughout the centuries people have explained the rainbow in various ways. Nations have accepted it as a miracle without physical explanation. For certain groups it was a token that there would be no more general floods. The Norsemen considered the rainbow as a bridge over which the gods passed from earth to their dwelling in the sky. Aristotle thought that the rainbow was caused by reflection of the sun's rays by the rain. The difference in the rainbow depends considerably upon the size of the water drops, and the width of the colored band increases as the size of the drops increases.

APPENDIX J

BASIC DATA

The scores given under "Ratings for Matching" are the same as those shown in Table 1.

The scores given for A, R, S, and F under the general heading of "Self-Ratings" are the median scores for each subject and were obtained by taking the median of the r ratings given to each of 40 speaking situations. The socres given for "Med." under the general heading of "Self-Ratings" is the median of the four scores for A, R, S, and F.

The scores given for F, T, D, and C under the general headings of "Spontaneous" and "Reading" are the median ratings for each subject and were obtained by taking the median of the three ratings given by the three judges at the University of Pittsburgh using the modified version of the Iowa Scale for Rating Severity of Stuttering. The scores given for "Med." under the general headings of "Spontaneous" and "Reading" were obtained by taking the median of the four scores for F, T, D, and C.

Due to an oversight, subjects E10 and C2 were not administered the Self-Ratings inventory at the middle testing session. This was taken into account by adjusting the formula for $\underline{t}$ sc as to reflect the different N.

FIRST TESTING

Sub.	Ratings for Matching	Age	No. Prev. Terms Therapy	Self-Ratings A	R	S	F	Med	Spontaneous F	T	D	C	Med	Reading F	T	D	C	Med
E1	7.0-6.5	19-08	1	3.0	3.0	3.0	4.0	3.0	7.0	6.0	5.0	5.0	5.5	6.0	6.0	4.0	4.0	5.0
E2	6.5-5.5	18-06	1	1.5	2.0	3.0	4.0	2.5	7.0	6.0	6.0	6.0	6.0	7.0	6.0	5.0	6.0	6.0
E3	5.0-5.0	19-05	0	2.0	3.0	3.0	5.0	3.0	7.0	4.0	3.0	4.0	4.0	7.0	4.0	3.0	3.0	3.5
E4	5.5-3.0	20-08	6	2.0	3.0	3.0	4.0	3.0	7.0	4.0	4.0	4.0	4.0	4.0	2.0	2.0	2.0	2.0
E5	4.5-4.0	20-02	0	4.0	4.0	3.0	5.0	4.0	6.0	2.0	2.0	4.0	3.0	6.0	3.0	2.0	2.0	2.5
E6	4.0-2.0	19-08	0	5.0	4.0	4.0	5.0	4.5	2.0	2.0	1.0	1.0	1.5	2.0	2.0	1.0	1.0	1.5
E7	4.0-2.0	20-11	5	1.0	2.0	3.0	5.0	2.5	5.0	3.0	4.0	4.0	4.0	3.0	2.0	2.0	3.0	2.5
E8	3.5-2.0	20-01	4	1.0	2.0	2.0	5.0	2.0	5.0	3.0	2.0	4.0	3.5	3.0	3.0	2.0	3.0	3.0
E9	1.0-1.0	19-09	4	2.0	2.0	3.0	5.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E10	1.5-1.0	21-08	1															
E11	3.5-3.5	20-04	0															
E12	5.0-2.5	24-04	0															
C1	7.0-7.0	22-02	1	1.0	2.0	2.0	5.0	2.0	7.0	7.0	5.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0
C2	6.5-6.5	18-03	1	2.0	2.0	2.0	3.0	2.0	7.0	7.0	6.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0
C3	5.0-4.5	18-02	1	2.0	3.0	3.0	5.0	3.0	7.0	5.0	3.0	5.0	5.0	6.0	4.0	3.0	4.0	4.0
C4	5.5-2.5	18-03	3	1.0	2.0	4.0	5.0	3.0	7.0	6.0	5.0	5.0	5.5	4.0	3.0	2.0	3.0	3.0
C5	4.0-3.0	22-07	1	2.0	3.0	3.0	5.0	3.0	5.0	4.0	4.0	4.0	4.0	3.0	3.0	2.0	4.0	3.0
C6	4.0-1.0	17-01	0	1.5	2.5	2.0	5.0	2.5	6.0	3.0	3.0	4.0	3.5	2.0	1.0	2.0	1.0	1.5
C7	2.0-2.0	18-02	0	2.0	2.0	3.0	5.0	2.5	3.0	2.0	1.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0
C8	2.0-1.0	20-06	5	2.0	2.0	2.0	5.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C9	1.0-1.0	21-11	0	2.0	2.0	2.5	5.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C10	1.0-1.0	20-09	0															
C11	5.5-3.0	23-08	1															
C12	4.5-2.5	21-10	0															

MIDDLE TESTING

Subj.	Self-Ratings A	R	S	F	Med.	Spontaneous F	T	D	C	Med.	Reading F	T	D	C	Med.
E1	3.0	3.0	3.0	5.0	3.0	7.0	6.0	4.0	4.0	5.0	6.0	6.0	2.0	3.0	4.5
E2	2.0	2.0	3.0	4.0	2.5	6.0	5.0	6.0	4.0	5.5	7.0	6.0	5.0	4.0	5.5
E3	2.0	2.5	3.0	5.0	2.5	7.0	5.0	4.0	6.0	5.5	7.0	6.0	4.0	6.0	6.0
E4	2.0	3.0	2.0	5.0	2.5	7.0	6.0	5.0	7.0	6.5	6.0	5.0	4.0	6.0	5.5
E5	3.0	3.0	3.0	5.0	3.0	6.0	5.0	5.0	4.0	5.0	6.0	5.0	4.0	4.0	4.5
E6	4.0	2.0	4.0	5.0	4.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E7	2.0	2.0	3.0	5.0	2.5	5.0	3.0	2.0	4.0	3.5	3.0	4.0	3.0	4.0	3.5
E8	1.5	2.0	2.0	4.5	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E9	2.0	2.0	3.0	4.0	2.5	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0
E10						6.0	2.0	2.0	6.0	4.0	3.0	2.0	2.0	4.0	2.5
E11	1.0	2.0	3.0	5.0	2.5	7.0	5.0	4.0	5.0	5.0	7.0	4.0	3.0	4.0	4.0
E12	2.0	2.0	2.0	5.0	2.0	5.0	4.0	4.0	4.0	4.0	2.0	3.0	5.0	3.0	3.0
C1	1.0	2.0	2.0	5.0	2.0	7.0	7.0	6.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0
C2						7.0	7.0	6.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0
C3	2.0	3.0	3.0	5.0	3.0	7.0	5.0	4.0	5.0	5.0	7.0	4.0	4.0	4.0	4.0
C4	1.0	2.0	3.0	5.0	2.5	7.0	5.0	4.0	4.0	4.5	4.0	4.0	3.0	4.0	4.0
C5	2.0	3.0	2.0	5.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C6	1.0	2.0	2.0	5.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C7	2.0	2.0	3.0	4.0	2.5	3.0	4.0	3.0	4.0	3.5	3.0	4.0	6.0	2.0	3.5
C8	2.0	2.0	3.0	5.0	2.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C9	2.0	2.0	3.0	4.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C10	2.0	2.0	3.0	5.0	2.5	2.0	1.0	2.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0
C11	2.0	3.0	2.0	5.0	2.5	7.0	4.0	4.0	4.0	4.0	4.0	3.0	2.0	3.0	3.0
C12	3.0	3.0	3.0	4.0	3.0	7.0	6.0	5.0	5.0	5.5	3.0	3.0	1.0	2.0	2.5

FINAL TESTING

Subj.	Self-Ratings A	R	S	F	Med.	Spontaneous F	T	D	C	Med.	Reading F	T	D	C	Med.
E1	3.0	2.5	3.0	4.0	3.0	6.0	6.0	4.0	4.0	5.0	5.0	5.0	3.0	3.0	4.0
E2	1.5	2.5	3.5	4.0	3.0	6.0	4.0	3.0	4.0	4.0	7.0	5.0	3.0	3.0	4.0
E3	2.0	2.0	2.0	5.0	2.0	7.0	5.0	4.0	4.0	4.5	7.0	4.0	3.0	3.0	3.5
E4	2.0	2.0	3.0	3.5	2.5	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E5	3.0	3.0	3.0	5.0	3.0	6.0	5.0	5.0	3.0	5.0	5.0	6.0	3.0	3.0	4.0
E6	2.0	2.0	3.0	5.0	2.5	2.0	2.0	1.0	4.0	2.0	1.0	1.0	1.0	1.0	1.0
E7	2.0	2.0	3.0	4.0	2.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E8	1.0	1.0	2.0	3.0	1.5	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0
E9	2.0	2.0	3.0	4.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
E10	3.0	3.0	3.0	5.0	3.0	1.0	1.0	1.0	1.0	1.0	3.0	2.0	1.0	2.0	2.0
E11	1.5	2.0	3.0	5.0	2.5	6.0	4.0	3.0	4.0	4.0	6.0	3.0	2.0	4.0	3.5
E12	2.0	2.0	2.0	5.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C1	1.0	1.0	1.0	5.0	1.0	5.0	2.0	2.0	4.0	3.0	6.0	4.0	3.0	4.0	4.0
C2	2.0	2.0	2.0	3.5	2.0	7.0	6.0	6.0	6.0	6.0	7.0	7.0	6.0	7.0	7.0
C3															
C4	1.0	2.0	4.0	5.0	3.0	6.0	3.0	2.0	3.0	3.0	2.0	1.0	1.0	1.0	1.0
C5	2.0	3.0	2.0	5.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C6	1.0	2.0	1.0	4.5	1.5	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
C7	2.0	3.0	2.0	5.0	2.5	4.0	3.0	3.0	4.0	3.5	3.0	3.0	3.0	4.0	3.0
C8	2.0	2.0	3.0	5.0	2.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C9	2.0	2.0	3.0	4.0	2.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C10	1.0	2.0	3.0	5.0	2.5	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
C11	1.0	2.0	2.0	5.0	2.0	7.0	6.0	4.0	5.0	5.5	5.0	3.0	2.0	4.0	3.5
C12	4.0	4.0	4.0	4.0	4.0	5.0	3.0	3.0	2.0	3.0	1.0	3.0	1.0	1.0	1.0